Both cases also show a marked tendency to periods of remission, during which there is a decided improvement of the symptoms. Such periods of remission are quite common in the diseases of the blood-producing organs, like pernicious anæmia, leukæmia, and pseudoleukæmia.

The effect of arsenic in Case II. was rather striking. The patient had at various times taken the drug—each time with a marked aggravation of the symptoms. The lowest white count was encountered while she was taking Fowler's solution. This corresponds with the known physiological action of arsenic, namely, that it stimulates the production of the erythrocytes, while it inhibits the formation of the white cells. Walter Broadbent has called attention to the dangers of the indiscriminate use of arsenic. He believes that many symptoms, like pigmentation of the skin, œdema, ascites, and the sensory disturbances of pseudoleukæmia, leukæmia, and pernicious anæmia are due to the arsenic taken.

The question of operation must be considered in these cases. In some cases splenectomy has brought about a cure; in others it has prolonged life. Knowing the powerlessness of drugs, the knife may be appealed to in suitable cases, even though its use is purely empirical.

A CLINICAL AND PATHOLOGICAL REPORT OF A CASE OF SPLENIC ANÆMIA.

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and

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1. Clinical Report (Dr. Sanford). *Case of anæmia of long duration with gastrointestinal disturbances and pain in splenic region; recent severe and repeated hemorrhages by stool and vomitus following traumata; blood characteristic of secondary anæmia of chlorotic type without leukocytosis, with no general lymphatic enlargement; idiopathic splenomegaly; exploratory laparotomy; subsequent splenectomy; death.* Mr. B. R. T., aged twenty-eight years, married, a farmer, of Greenwich, Ohio, was sent to Lakeside Hospital on the evening of October 14, 1903, with symptoms of vomiting of blood, tarry stools, profound anæmia and a tumor in the lower mid-abdomen.

The patient stated that three weeks before he had been thrown over the head of a spirited horse and had struck flat on his back, but had not been prevented from working about as usual. Two weeks later, which was a week before entrance, he was jerked off his feet and thrown violently some distance by this same horse which he was leading. The following morning he had a copious black liquid stool, after which he vomited much blood, he thinks at least a pint, of both dark blood clots and some fresh blood. This vomiting continued at intervals that day, and then stopped, but he had large tarry stools nearly every day up to the time of his entrance. He was in bed during most of the time, felt greatly prostrated, and had no appetite.

His physician on the day before he was brought to the hospital first noticed a tumor in the lower mid-abdomen, which he took to be a distended bladder, but on catheterization its size was not altered. The urine appeared normal and contained no blood. Dr. Maynard, of Elyria, who was called in consultation, then sent him to the hospital. On entrance the patient seemed greatly fatigued from his journey and could answer questions with difficulty.

Physical Examination. Patient is a young American, slight in frame, very sallow, somewhat emaciated, in considerable state of shock. Temperature, 100.6°; pulse, 120, small volume, regular, compressible; respiration, 28.

Sclera subicteric; teeth poor; tongue furred and moist.

Chest, slender and shallow, expansion equal and good; clavicles and ribs prominent; supraclavicular and infraclavicular fossæ deep; no glands palpable. Interspaces sunken; epigastric angle narrow.

Percussion note dull over clavicles and supraclavicular spaces, elsewhere hyperresonant. Breath sounds clear front and back; musical rales on expiration in left foreaxillary line.

The area of cardiac dulness is hard to define; it apparently extends somewhat to the right of the sternum; a blowing systolic murmur is heard all over the base, and not at the apex or in the axilla.

The abdomen is sunken, scaphoid in general outline, somewhat sensitive to palpation in the left upper quadrant where there is slight muscular rigidity. Liver dulness begins at the fifth space in nipple line and extends to costal margin. Splenic dulness not made out. The pole of right kidney is palpable on deep inspiration. Left kidney not felt, and it seems with one hand in the left lumbar region and the other under the left costal margin that the two hands can be brought nearer together with less intervening structures on the left than on the right side. On pressure here the patient is evidently sensitive, although apathetic to examination elsewhere. Just below the umbilicus is a mass, oval in general outline, lying diagonally, its higher pole to the right, smooth, hard, not tender, quite freely movable, edges rounded, no notches felt. The abdomen is everywhere tympanitic except over the mass described where the note is flat.

The inguinal glands are slightly enlarged. Rectum empty except for a few small clots; no hemorrhoids; extremities thin; no tibial scars or œdema.

The patient was given artificial heat and stimulation by strychnine and saline subcutaneous infusions every six hours. Milk and whites of eggs; morphine for restlessness. A glycerin enema resulted in a black liquid stool, which on examination was found to be largely decomposed blood.

The immediate history of severe repeated traumatisms combined with the patient's statement that he had always been well previously, quite naturally led one to regard the present symptoms as the direct result of the injury rather than to seek a more remote cause. Various possibilities were considered, among which hemorrhage from a gastric or duodenal ulcer, and a dislocated viscus were foremost. Neither diagnosis seemed to account for all the symptoms, and in view of the later developments in the case, a further discussion of these points is unnecessary.

The patient reacted fairly well to stimulation, and was kept under observation the next day, during which he had seven more black liquid stools. Rectal feeding was added to the treatment which was otherwise the same.

A blood examination on the day after admission showed: Reds, 2,800,000; leukocytes, 8000; hæmoglobin, 25 per cent.; coagulation time 45 seconds; no plasmodia seen.

The next day the patient's unchanged condition and the uncertain diagnosis seemed to warrant an exploratory operation which was decided upon.

Operation, October 16th (Dr. Dudley P. Allen. Gas and ether). *Laparotomy; exploration.* An incision 9 cm. in length was made in the median line below the umbilicus and over the tumor. A small quantity of clear peritoneal fluid was met with from which cultures were taken. The intestines were normal. The mass was identified as the spleen, greatly enlarged and displaced, freely movable, otherwise of normal appearance. Accurate measurements were not taken, but the organ seemed at least two or three times its normal size. The surgeon considered any operative procedure on the spleen unwise in the patient's condition and closed the incision. Another incision in the median line of the epigastrium was then made and the stomach inspected, and found normal. Nothing abnormal felt about the liver, gall-bladder, appendix, or pancreas. Palpation of the kidneys showed them apparently normal in position and size. The incisions were then closed. The patient received very little shock from the operation, which took but fifteen minutes.

The conditions found at operation raised the question whether the traumata might not be coincidences or, perhaps, exciting causes in producing the appearance of symptoms primarily due to some as yet unrecognized organic lesion. The arrival of the patient's friends gave the first opportunity of getting the family and previous history in the case, which was as follows:

Family History. Father died of "broken back" at the age of seventy years. Mother and one brother living and well. An uncle died of heart disease. No history of malaria, syphilis, cancer or tuberculosis in the family.

Previous History. Patient had children's diseases. He has always been pale since childhood. Between seven and eight years ago he had an attack of very violent vomiting which continued all night and was not connected with any indiscretion in diet; vomitus contained no blood. He has always had poor digestion, often distressed after meals, sometimes vomiting, with relief to the discomfort.

In the summer of 1902 he had "bowel trouble," in which there was diarrhœa, griping pains, severe vomiting, with some blood in stools and vomitus. From this time up to the injury the patient was not well, and was under a doctor's care for general "ill feeling" and frequent urination. In the winter of 1902, he also complained of a good deal of dragging pain in the back and left side. No history of venereal disease; tobacco in moderation; no alcohol. Patient has not lived in a malarial district and never had periodic chills.

With this suggestive history and the enlarged and dislocated spleen found at operation, a detailed blood examination was then made and showed the following conditions: Reds, 3,480,000; leukocytes, 8500; hæmoglobin, 25 per cent. Differential count of 600 cells: polymorphonuclears, 74 per cent.; small mononuclears, 18 per cent.; large mononuclears, 4 per cent.; transitional forms, 1.5 per cent.; eosinophiles, 2.5 per cent. Red cells took stain poorly, and were variable in shape and size, centre quite thin, no rouleau formation, some poikilocytosis, six nucleated reds seen; no plasmodia.

The urine was amber, clear, specific gravity, 1020, acid, no sugar, faint trace of albumin, sediment, few leukocytes, epithelial cells.

The case then presented the following data: A patient with (1) a previous history of an anæmic condition with gastrointestinal disturbances and pain in the splenic region; (2) an immediate history of severe and repeated hemorrhages by stool and vomitus following traumatism; (3) a present condition of profound anæmia, with the blood characteristic of a secondary anæmia of the chlorotic type without leukocytosis, with no general lymphatic enlargement; and (4) a splenomegaly apparently not due to malaria, syphilis, tuberculosis, leukæmia, or amyloid disease. From this symptom-complex the possibility of the existence of splenic anæmia was strongly suggested and a course of supporting treatment was instituted while further study could be carried on.

During the week after operation the patient's general condition improved slightly. The stools no longer contained fresh blood, but were dark, copious, watery, varied between three and seven daily and were at times involuntary. There was no further vomiting. Liquid nourishment was well taken. The temperature ranged between 99.5° and 101.5°, and the pulse from 100 to 140. The outline of the tumor was marked out on the abdomen in silver nitrate solution to watch for changes in its size or position.

On the tenth day after operation the tumor was found to have increased in size by almost one-half, and the gain in size seemed mostly toward the right and below. The new outlines of the enlarged organ were marked on the patient's abdomen. Two days later a still further very rapid increase in size was apparent, so that the anterior surface of the mass presented an area twice as large as when the patient entered the hospital. The incisions of the original exploration were firmly healed by first intention. To-day for the first time petechial hemorrhages were seen on the sides of the chest in areas the size of the palm of the hand, and smaller similar purpuric spots appeared on the right forearm and hand.

No change in subjective symptoms accompanied these new phenomena. The patient was still apathetic and weak, though he declared he felt better, and his only complaint was the exhaustion attendant on frequent bowel movements which still were of a tarry color and averaged five to six daily. The blood condition was examined from day to day, and showed practically the same condition as given above.

The question of splenectomy in the case had been constantly before the surgeon's mind, but he desired first to improve the patient's general condition in view of the recent enormous loss of blood he had suffered. The rapid and sudden increase in the size of the spleen, however, convinced Dr. Allen that ground was being lost instead of gained, and an immediate operation was proposed and accepted by the patient and his friends.

Operation October 29th (Dr. Dudley P. Allen. Gas and ether). *Laparotomy; splenectomy; closure.* A vertical incision 15 cm. in length was made separating the fibres of the left rectus muscle in order to avoid the former incisions. On opening the peritoneum some clear fluid was met with from which cultures were taken. The spleen was found to be lying free in the abdomen without adhesions to the intestines or other structures, its only attachment being a large long pedicle containing four twists, composed of large congested vessels, some of which contained thrombi. A more detailed, microscopic description of the organ and its pedicle will be given later.

The pedicle was securely tied high up with silk, clamped off distally and removed with the organ, which was with difficulty squeezed through the skin incision. No hemorrhage accompanied the removal; the pedicle stump was reinforced by over-and-over catgut stitches, and showed the openings of several large vessels.

The abdomen was closed in layers. The patient seemed to receive no shock from the operation which lasted twenty minutes.

For two days after operation the patient's general condition was encouraging. The temperature approached the normal, and the pulse rate decreased to an average of 90, with improvement in its quality. Stimulation with strychnine and saline subcutaneous infusions was continued as before.

On the third day a marked œdema of the whole right leg appeared which increased rapidly to alarming proportions. This was followed some days later by œdema of the right side of the scrotum and left side of the neck. Vomiting reappeared on the sixth day, and it became difficult to nourish the patient, as rectal nutrition was not retained except at intervals. There was no further appearance of blood, however, either in the vomitus or stools. Purpuric areas remained unchanged. Later the vomiting ceased and the patient seemed much brighter again. An attempt was made to give Fowler's solution, but this had to be abandoned, as on the eleventh day the patient again rejected all nourishment. The abdomen, which up to this time had been flat, now began to show distention, with appearance of free fluid in the flanks. This collected rapidly, and on the thirteenth day the abdominal wound, which had healed and from which the stitches had been removed, burst open and a large amount of clear fluid escaped, from which cultures were sterile.

The patient now was irritable and very hard to rouse, sleeping nearly all the time with some delirium. Nourishment was refused, and rejected when given. Stools and urination were involuntary. This condition of progressive weakness, accompanied by emaciation, dyspnœa, and cyanosis, continued until the patient's death on November 15th, seventeen days after operation.

The changes in the blood following the removal of the spleen were very interesting, and in the main coincided with observations reported under like conditions in other cases, though, unfortunately, the patient's death prevented their being followed out over a long period.

Immediately after operation there was a great diminution in the red corpuscles from 3,480,000, four days before operation, to 1,836,000 two days after operation. This could not be accounted for by hemorrhage, either before or during the operation, as there was no great loss of blood immediately before the operation and no blood was lost in tying off the pedicle of the spleen. It must be attributed to the effect of the removal of the organ. After this initial drop the red count began steadily rising and had reached 2,800,000 just before death.

The white count which had been 8500, jumped to 34,000 two days after operation and gradually decreased to 22,000 at death. The percentage of hæmoglobin which before operation was 25 per cent., dropped to 22 per cent. after operation, and then gradually rose to

28 per cent. All these changes, the marked postoperative diminution in red cells, and to a less degree in hæmoglobin, and the sudden rise in leukocytes, corroborate previous experiences following splenectomy.

In the differential counts the polymorphonuclear form showed a marked increase from 74 per cent. before operation to 93 per cent. before death. The eosinophiles varied in amount. Nucleated red forms which averaged 6 in a count of 600 cells before operation increased to 36 before death.

To facilitate comparison the results of the various counts are tabulated below.

	Date.	Red cells.	Leukocytes.	Hæmoglobin.
Before operation	October 16	2,800,000	8,000	25 per cent.
	" 25	3,480,000	8,500	25 "
After splenectomy	November 2	1,836,000	34,800	22 "
	" 3	1,914,000	30,000	23 "
	" 7	2,212,000	22,000	22 "
	" 10	2,848,000	23,720	28 "
	" 11	2,464,000	26,000	26 "
	" 12	2,568,000	23,000	27 "
	" 13	2,632,000	22,000	28 "
	" 14	2,682,000	22,000	28 "

DIFFERENTIAL COUNTS OF 600 CELLS.

	Date.	Polymorphonuclear.	Small mononuclear.	Large mononuclear.	Transitional.	Eosinophiles.
Before operation	Oct. 25	74.0 per ct.	18.0 per ct.	4.0 per ct.	1.5 per ct.	2.5 per ct.
After splenectomy	Nov. 2	83.5 "	12.75 "	1.75 "	1.50 "	0.5 "
	" 7	89.0 "	4.66 "	2.33 "	2.0 "	2.0 "
	" 10	93.0 "	3.8 "	1.4 "	0.6 "	1.2 "
	" 13	92.3 "	3.6 "	1.3 "	1.0 "	1.8 "

2. PATHOLOGY. (Dr. Dolley.) *Autopsy Protocol.* (Autopsy performed seventeen hours after death.) The body is that of a well-formed but emaciated white man, 180 cm. long. There is moderate rigor mortis, and slight posterior hypostasis. The conjunctivæ are somewhat yellow. The mucous membranes are pale. The skin is sallow but not pigmented. A few small petechial areas are scattered just above the costal border. There is no glandular enlargement.

The chest is barrel-shaped. The supraclavicular fossæ and sternal notch are deep. The abdomen is scaphoid. Two recently healed wounds of operation appear in the midline; one, 6 cm. long, beginning at the xiphoid cartilage, the other, 7 cm. long, beginning at the umbilicus. A third laparotomy wound, healed with the exception of one stitch, 12 cm. long and 3 cm. to the left of the umbilicus, is present in mid-abdomen. The right leg is larger than the left throughout, and moderately œdematous.

Brain and *spinal cord* not examined.

Abdominal Cavity. The spleen is absent. The splenic veins become very tortuous from the end of the pancreas, one and one-half coils being left after the splenectomy. They measure from the end of the pancreas to their ligated extremity 2.5 cm. coiled and 5 cm. uncoiled. The apposing surfaces of the coils are united by well-organized adhesions. Beginning at the junction with the portal vein, the splenic vein and its branches become more and more distended with palpably soft material until at their ligated extremity the larger of the two branches is 2 cm. in diameter. The veins are attached to the jejunum at one spot, 2 cm. in diameter, by organizing fibrinous exudate. On incision they contain soft mixed thrombi, which in places are loosely attached to the wall. There is slight thickening of the walls but no evidence of calcification.

The *splenic artery* is rather tortuous and dilated. It measures 2.5 cm. from the end of the pancreas to its ligated extremity. Its elasticity is poor, the intima is somewhat roughened and extremely reddened toward the distal end. It contains a similar grayish-red thrombus.

Mediastinal fat is scanty. The *thymus* is absent.

Pleural Cavities. Each contains about 10 c.c. of clear serous fluid. There are no adhesions.

The *pericardial cavities* contain 30 c.c. of similar fluid. The sac wall is not thickened.

Thyroid Gland. Both lobes are somewhat enlarged. The tissue appears normal.

The *tracheal glands* are markedly anthracosed. One at the bifurcation is studded with small fibrocaseous tubercles.

The *lungs* are voluminous, externally smooth and slightly anthracosed. They are hypercrepitant and cushiony except in the lower posterior portions. On section there is moderate hypostasis of the lower lobes. Elsewhere the tissue is more moist than normal. The left weighs 550 grams, the right 549 grams.

The *bronchi* contain some frothy watery mucus.

The *bronchial glands* are like the tracheal. One is composed of a calcified envelope with a caseous centre.

The *heart* is of normal size. The right ventricle averages 4 mm., the left 15 mm. in thickness. The auricles and right ventricle contain post-mortem jelly clots. Fluid blood is scant. The muscle is pale and flabby. The valves are normal except for a few atheromatous patches on the ventricular surface of the right mitral segment. The circumferences of the valvular orifices are: aortic, 6.2 cm.; pulmonic, 7.3 cm.; mitral, 9.5 cm., and tricuspid, 13 cm. The coronary arteries have a roughened intima with considerable atheroma. They are not tortuous. The endocardium elsewhere is smooth.

Aorta. The elasticity is normal. The wall is not thickened. The intima in places is roughened by yellowish or whitish plaques.

The *pulmonary artery* and *venæ cavæ* appear normal.

The *liver* weighs 1356 grams. It measures 27 x 14 x 8½ cm. The left lobe measures 13½ x 14 x 5 cm. It is contracted, but its shape is fairly preserved. The capsule is slightly thickened, and the capsular veins are moderately injected. The veins of the round ligament are not dilated. The surface is moderately roughened and nodular, especially over the inferior and lateral portions of the right lobe. Over the inferior surface are several nodules softer in consistence than the rest of the tissue. On section, the organ is moderately hyperæmic. The cut surface is uneven and finely, though not uniformly, granular. The tissue is firm and cuts with increased resistance, especially in the lower and lateral portions of the right lobe, just under the capsule. The lobular outlines are not distinct; the tissue is markedly bile-stained, of a dirty brownish-yellow color. Owing to the bile staining the character of the apparently increased connective tissue is not evident. Glisson's capsule is most affected.

The *portal vein* is not thickened and its intima is smooth; it is free from thrombi.

The *gall-bladder* is constricted at the junction of its proximal and middle thirds and bent upon itself, so that the two portions are in partial apposition and united by old adhesions. Elsewhere it is non-adherent and apparently normal, containing dark bile. The ducts are patent.

Œsophagus. Congested sub-mucosal veins are distinct about the cardiac orifice.

The *œsophageal veins* are considerably dilated and tortuous. The coronary veins of the stomach are not so dilated, but the cardiac branches communicating with the œsophageal veins show marked varicosity.

The *stomach* is somewhat dilated, but the wall is not appreciably thinned. It contains 500 c.c. of brown sour-smelling fluid. The mucosa shows considerable post-mortem change and is not indurated. The sub-mucosal veins about the cardia and along the greater curvature are dilated. The folds of the mucosa only appear along the greater curvature, where their prominence is due to dilated veins. No eroded veins are apparent. There are no ulcers nor scars.

The *pancreas* is moderately hyperæmic. The head and body are of normal size, but are distinctly indurated. The tail is very contracted and firmly attached to the splenic vessels. On section there is great increase of dense fibrous tissue.

The *small intestine* is not distended. It shows only an occasional congested but not swollen area in the mucosa. The veins of the serosa are not congested.

The *appendix* is normal.

Large Intestine. The mucosa of the cæcum and the ascending colon is markedly congested. There are no hemorrhoids.

The *suprarenals* show post-mortem softening of the medulla.

Kidneys. Right weighs 215 grams, the left 285 grams. They measure respectively 12 x 7.5 x 3.8 and 13 x 8.6 x 7 cm. Perirenal fat is scanty. The cortical veins are not dilated. The capsule is normal.

The cortex of the right is 6 mm., of the left 8 mm. in thickness. The cut surface is smooth, but mottled with grayish areas corresponding to the labyrinths. The organs are moderately pale and the glomeruli are barely visible. The arteries are not sclerotic.

The *ureters, bladder, seminal vesicles, prostate,* and *testicles* appear normal.

The *mesenteric glands* are small and barely palpable.

The *retroperitoneal glands* are enlarged, firm, and of a glistening grayish-white appearance on section.

Hæmolymph Glands. Lying on both sides of the sternum, along the carotid arteries, the renal vessels, the iliac vessels, and about the splenic vein and the œsophagus appear glands varying in size from a pinhead up to that of a large bean. These are soft, dark-red, spleen-like and fairly abundant. Between thirty and forty of convenient size were removed.

The *right iliac vein* just above Poupart's ligament is filled with a red, non-adherent thrombus.

The *right femoral vein* contains a similar thrombus. This changes in character 5 cm. below Poupart's ligament, having a white friable core which at one point is attached to the wall.

The *inferior hemorrhoidal veins* are moderately dilated and tortuous.

Bones. Several ribs and the right femur were opened and found to contain bright-red and succulent marrow. No lymphoid areas appear.

Spleen (received from the surgical department. Gross description by Dr. Howard). The specimen consists of a spleen, irregularly oval in shape, presenting a rounded anterior margin from which the notch has been obliterated. It weighs 1650 grams and measures 22 x 16 x 7 cm. The vessels, which form a pedicle, are covered with fine pinpoint fibrin masses, but present no adhesions. This pedicle is twisted four times, and its uncoiled state measures 17 cm. in length and 4 cm. in its greatest diameter. It is composed of several large tortuous veins surrounded by a considerable amount of fat, and several branches of the splenic artery, which is divided a considerable distance from the hilus. The pedicle also includes a soft body measuring 1.5 x 1 cm., covered with peritoneum, and resembling an enlarged lymphatic gland. At the distal end mixed gray and red thrombi protrude from the veins. The largest vein is 2.5 cm. in its greatest diameter. On incision they are filled with thrombi, but contain a variable amount of thin fluid blood. The thrombi are partly red and partly mixed, some being yellowish-gray in color. As a rule they are non-adherent, or can be easily separated. In general the mixed thrombi are soft or friable. The thrombi can be readily traced into the large and the small veins of the organ. The walls of the veins are not much thickened, and show no signs of recent or old inflammation except the thickening of one near the hilus.

The splenic tissue is light brown in color and œdematous. The trabeculæ are well marked, the lymph nodes obscure. The tissue is not friable. There are no infarcts.

Microscopic. Material from all organs was hardened in Zenker's and Orth's fluid, in formalin and in alcohol, and stained by ordinary and special methods.

Lungs. There is moderate emphysema and anthracosis. The sections from the posterior portions show moderate congestive œdema. The bronchi and pulmonary arteries are normal. Careful search for the bone-marrow giant cells described by Warthin in his cases was negative.

Heart. There is marked segmentation and some fragmentation of the muscle.

Liver. The connective tissue is moderately increased, but not at all uniformly even in the same section. The increase is greatest in the right lobe under the capsule, as noted macroscopically, Glisson's capsule about the larger vessels being particularly thickened. The lobules are usually sharply defined, but occasionally the connective tissue extends somewhat into them. The connective tissue is dense fibrous in character, with few nuclei, and slight round cell infiltration. In places of more marked fibrosis, fibroblastic cells are more abundant, but the tissue is nowhere actively proliferating. More rarely an increase of fibrous tissue about the central veins is noted. Mallory's connective-tissue stain shows here and there a slight increase of the reticulum of the lobules. This is more prominent in areas of atrophy of the lobular centres. This reticulum takes a light red with Van Gieson's stain. A very few fibroblastic cells appear in these areas and several capillaries are filled with proliferating endothelial cells with a few karyokinetic figures. Excepting these few instances endothelial proliferation does not occur. In the more cirrhotic portions many lobules show dilatation of the central veins and capillaries with some atrophy of the liver cells, but this is appreciable in but few lobules in the less fibrosed areas. The atrophic liver cells present more or less fatty degeneration and necrosis, with a little brownish-yellow pigment. Numerous attempts to demonstrate the presence of iron were unsuccessful. Proliferation of bile canaliculi is found in only two areas. No bone-marrow giant cells are found.

The *stomach* and *intestines* show chronic passive congestion, associated in the small intestine with slight chronic catarrhal inflammation.

Pancreas. Sections from the head and body show a moderate increase of connective tissue, both perilobular and interacinous. Some islands of Langerhans also have an increased amount of stroma. The sections from the tail show marked fibrosis, dense fibrous and hyaline tissue replacing many lobules, while the remaining ones are small and distorted. The ducts have a thickened wall and a few are tortuous. The islands of Langerhans are diminished in number. A few are unaffected. In some there is fibrosis, but in others fatty and granular degeneration of the cells is more pronounced. The veins are moderately congested and have thickened walls, particularly in the tail.

The *kidneys* show a very slight chronic interstitial nephritis. There is no deposition of pigment.

The *portal* vein is normal.

Splenic Veins. The intima is slightly and irregularly thickened and is composed of dense fibrous tissue with few nuclei. Thickening of the adventitia is more pronounced. In the latter, particularly about the vasa vasorum, there is moderate fibroblastic proliferation. But few fibroblastic cells occur in the intima and media. Organization of the thrombi is well advanced in places.

The *mesenteric glands* are fibrosed. There is some proliferation of the endothelium.

Hæmolymph Glands. A few are of the marrow lymph type described by Warthin, but show partial transformation into ordinary lymph glands. The lymph spaces are full of endothelial cells, some of which are phagocytic for red blood and lymphoid cells. Only a moderate number of bone-marrow giant cells appear.

The majority of the hæmolymph glands resemble splenic tissue in structure. The follicles contain no germinal centres and usually show small hyaline areas. The blood sinuses, which are much dilated, are only partly filled with blood. The most striking feature is the presence within them of numerous large cells of endothelial type packed with red blood cells. Mononuclear eosinophiles appear in great numbers, and normoblasts are moderately numerous. A few mastzellen are present. Numerous cells resembling myelocytes appear in the blood sinuses, but these are more abundant in the lymph spaces of the glands of marrow lymph type (Wright stain). Pigment is in moderate amount. It gives the iron reaction with ferrocyanide and HCl. Some phagocytic cells give the same reaction in a diffuse way.

The *bone-marrow* (rib) is of a poor lymphoid type. Giant cells are not apparently reduced in number. Plasma cells and polymorphonuclear leukocytes are in small proportion, but mononuclear eosinophiles with nuclei varying greatly in size are extremely abundant. Polymorphonuclear eosinophiles, while absolutely increased, are less numerous relatively. Normoblasts appear in large numbers with active mitosis. Myeloblasts are only occasionally seen. Neutrophilic myelocytes are almost entirely absent. A peculiar feature with the Wright stain is the presence of cells resembling lymphocytes, but with a red protoplasmic border. Excluding these, ordinary lymphoid cells are not increased in number.

There is a scanty amount of iron containing pigment, both in cells and free.

Spleen. The capsule is moderately thickened and composed of a dense hyaline connective tissue. The trabeculæ are also thickened and are farther apart than normal. The splenic tissue is constructed of considerably dilated blood spaces, more or less filled with blood, and separated by a moderate amount of usually dense fibrous tissue with a varying number of fibroblasts. Under the capsule this newly formed connective tissue is much more abundant, and it is not uniform in the other sections, thick fibrous bands appearing here and there. Hyaline transformation of the connective tissue appears nowhere outside of the trabeculæ proper. The venous spaces are lined either by an almost flat or a somewhat swollen endothelium with an occasional free cell, but no proliferating endothelium appears. Scattered through the pulp are relatively few lymphoid cells and an almost equal number of polymorphonuclear leukocytes. The lymph nodes are farther apart than normal, but it is not possible to say they are absolutely diminished in number. They are usually not atrophic but show an increase of coarse reticulum with a few fibroblasts. Often the central arteriole is thickened and hyaline. The veins are greatly dilated, their walls are moderately thickened and many contain fibrinous and mixed thrombi. Not infrequently small fibrinous clumps appear in the blood spaces.

A very moderate amount of pigment is deposited in phagocytic cells in the blood spaces or in the stroma or lies free in the trabeculæ. It gives the iron reaction. A few normoblasts, plasma cells, and mononuclear eosinophiles are to be seen, but neither myelocytes nor bone-marrow giant cells are found.

With the Van Gieson stain there is considerable variation, but a large part of the newly formed stroma takes a deep-red color. A section throught one of the splenic veins removed at operation shows the same degree of fibrous thickening as in the stump. The adventitia is the seat of a much more marked fibroblastic proliferation. The thrombus is just beginning to organize.

Pathological Summary. There is nothing in the histological structure of the spleen which cannot be explained simply by chronic passive congestion. In the causation of this, two factors have to be considered—*i. e.*, the abnormality of the splenic vessels and the cirrhosis of the liver. The dislocation of the spleen must have been of long standing, for the splenic vessels uncoiled measured 19.5 cm. from the end of the pancreas. Granting even that the multiple twists all occurred as a result of the accidents, which is hardly probable, the elongation which existed prior to this must have caused considerable interference with the splenic circulation.

In two cases of splenic anæmia, reported by Dock and Warthin, there were stenosis and calcification of the portal vein, a condition identical with this one as far as the effect on the spleen is concerned. The question they raise is whether the portal lesion is primary and the splenic fibrosis secondary to it, or, on the other hand, whether the splenic condition is primary, while the condition of the portal vein is coincidental or results from a toxic condition of the portal blood dependent upon the disturbed splenic function or dependent upon a portal or general intoxication. The dislocation of the spleen could not have been of congenital origin, for the alteration does not indicate such a long-standing condition, and an enlargement of the organ at once suggests itself as the main factor in its production.

The abnormality of the splenic vessels is essentially a mechanical, not an organic one. Granted that some enlargement of the spleen, from whatever cause, started the elongation of the splenic vessels, once produced, with probably some torsion, the reaction on the circulation of the dislocated organ would be so great that the subsequently increased congestion and fibrosis would result largely from the condition of the vessels. The condition of the spleen must be considered then as largely secondary to that of the vessels, which gives them a very probable etiological significance. If splenic anæmia existed before the dislocation of the spleen, and the initial enlargement and the dislocation of that organ were manifestations of the pathological processes of the disease, the splenic vessels lose their casual relationship. But the histological structure offers no evidence of this. There is not even the proliferation of endothelium so commonly found in the spleen in this disease to complicate the picture.

The relationship of the cirrhosis of the liver to the condition in the spleen presents the greatest difficulty in interpretation. In part the process in the liver is regarded as a mild and not uniform chronic passive congestion, with a just beginning central cirrhosis, shown by the increase of fine reticulum in the atrophic portions of the lobules, with some endothelial proliferation. The moderate emphysema of the lungs offers a probable explanation for this condition. More important there is also a moderate though irregular increase of periportal tissue, but the histological pictures of the fibrosis in the liver and in the spleen are too nearly identical to draw conclusions regarding time relationship. What part the liver played in the production of the splenic condition it is impossible to say. Was the hepatic process primary, and was the initial enlargement of the spleen leading to its dislocation secondary to it, or were the two processes coincident? The fibrosis in the liver and in part that in the spleen may have resulted from a general or portal intoxication.

The changes in the hæmolymph nodes are interpreted as compensatory for the failing splenic function. It is probable that the bone-marrow shared to some degree in the assumption of this function. But the presence of pigment and phagocytes in the spleen would, however, indicate that this function was not entirely lost, while the moderate evidence of old hæmolysis in the hæmal glands would further bear this out. But these glands show an excessive number of phagocytes full of intact red blood cells which is readily explained by the results of Warthin's work. He concludes from his experiments with sheep that hæmolysis and leukocyte formation are the functions taken up by the hæmal glands after splenectomy. But the hæmolytic action of these glands exceeds that of the normal spleen, and the resulting anæmia is compensated for by increased activity on the part of the bone-marrow. The marked fall in the blood count after splenectomy was due then to this excess of hæmolymphatic hæmolysis over that of splenic.

No iron pigment could be demonstrated in the liver and kidneys. This fact, together with the paucity of megaloblasts in the bone-marrow, indicates that the anæmia was not primary in type. While the hyperactivity of the hæmolymph glands would explain the anæmia which undoubtedly existed before the accidents, the intestinal hemorrhages following them reduced the patient to his state on entering the hospital.

Pathological Diagnosis. Dislocation of the spleen with marked elongation and torsion of its vessels, and thrombosis. Chronic passive congestion and fibrosis of the spleen. Interlobular atrophic cirrhosis of the liver. Chronic passive congestion with beginning central cirrhosis of the liver. Chronic passive congestion of rest of portal system. Compensatory hyperplasia of hæmolymph nodes. Hyperplasia of the bone-marrow. Secondary anæmia. Moderate diffuse emphysema of the lungs. Tuberculosis of bronchial and tracheal glands.

My thanks are due to Dr. W. T. Howard, Jr., for the use of material and for his interest in the work.

3. GENERAL SUMMARY. The patient's previous history of pallor, digestive disturbances, and pain in the splenic region, symptoms of which there is a history for a number of years, strongly suggest the

early stage of a splenic anæmia. The frequent urination and the pain in the splenic region also would imply a long-standing dislocation of the spleen. This is corroborated by the enormous elongation of the splenic vessels. Whether or not all the twists in the splenic veins occurred at the time of the two accidents, it is impossible to state, but it is at least more reasonable to suppose that from their multiple character they did not all occur at one time, but that some had existed previously.

The thrombosis of the splenic vessels must have been the cause of the sudden enlargement of the spleen while the patient was in the hospital. The lack of organization in the thrombi of the vessels removed at the splenectomy proves this.

If Banti's stage of splenic anæmia is limited only to those cases in which the cirrhosis is a terminal manifestation we cannot include our case in that category, for the cirrhosis of the liver is certainly of as long standing as the fibrosis in the spleen. We prefer to regard the case as one of splenic anæmia associated with a cirrhosis of the liver, not as a result of the process in the spleen, but rather accompanying it.

The enormous elongation and torsion of the vessels associated with the dislocation of the spleen possess a very probable etiological significance in this case.

SARCOMA OF THE SMALL INTESTINE:

WITH EXTENSIVE METASTASIS IN THE HEART MUSCLE AND EMBOLISM OF THE SUPERIOR MESENTERIC ARTERY.[1]

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In 1900 I published five cases of sarcoma of the small intestine and collected about fifty other cases from the literature.[2] Since that time we have had in the hospital ten further cases of this disease, in addition to which a small number of cases has also been reported by various other observers, most of which are collected in the valuable monograph of Lecêne[3] published during the past year.

In none of the cases which I have seen or which I collected from the literature was there any note of metastatic deposits in the heart,

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[1] Demonstration at the meeting of the New York Pathological Society, December 14, 1904.

[2] The American Journal of the Medical Sciences, 1900, vol. cxx. p. 309.

[3] Les tumeurs malignes primitive de l'intestin grêle, Paris, 1904; Mittheilungen aus den Grenzgebeiten, Bd. vii. Heft 415.